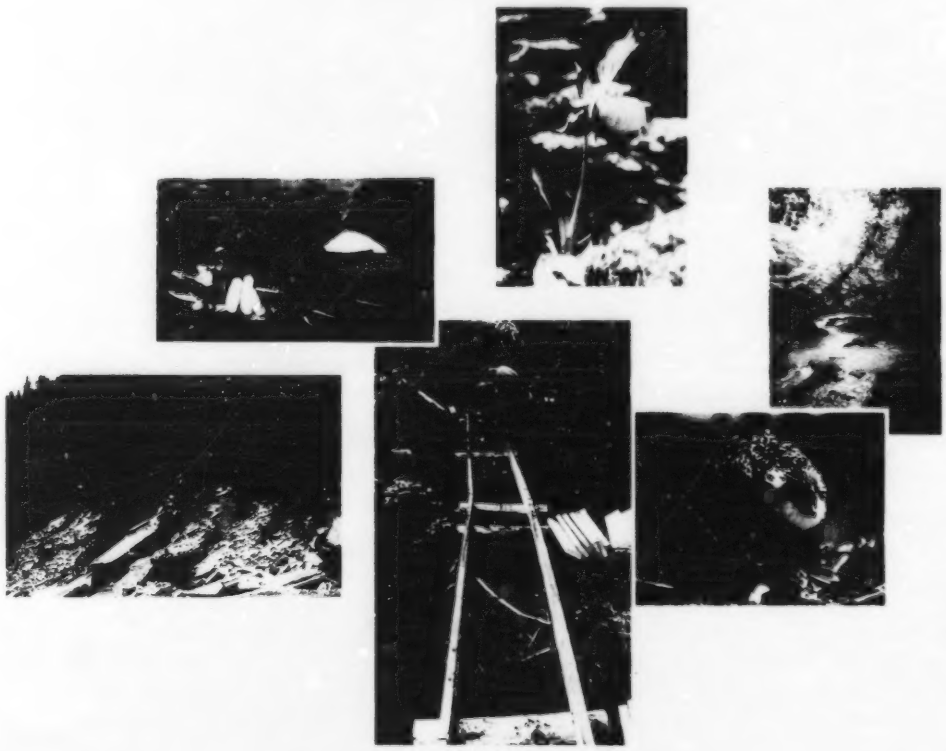
Habitat Health

Status and Trends in Fish and Wildlife Habitat on the Canadian Side of Lake Ontario



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ACKNOWLEDGEMENTS

This report was written by Ron Reid of Bobolink Enterprises. It is a summary of a report entitled *Fish and Wildlife Habitat Status and Trends in the Canadian Watershed of Lake Ontario* (available at: www.on.ec.gc.ca/glimr/lakes/ontario/). Many individuals and agencies reviewed, provided data or maps to the full report and their contributions are gratefully acknowledged.

Design and printing by Neglia Design Inc.

© April 2001
ISBN 0-662-29982-5
Cat No. CW69-5/364-1E

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In Summary:

A healthy Lake Ontario includes healthy habitats for fish and wildlife, both in the lake and its watershed. What are habitat conditions right now? Are things getting better or worse? What stresses does the natural environment face? What's being done to protect and restore habitats? This report, which summarizes a more detailed analysis of the status of fish and wildlife habitat, provides some of the answers.

Watershed: DEGRADED AND SLOWLY GETTING WORSE

Population and urban growth are creating enormous stresses on woodlands, wetlands, and other habitats. **See pages 4 to 6.**

Tributaries: DEGRADED BUT STABLE

Pollution such as sediments and toxins have declined, but most valleys lack sufficient streamside vegetation and have unstable flow patterns. **See pages 7 to 9.**

Nearshore Lands and Waters: DEGRADED BUT PARTIALLY RECOVERED

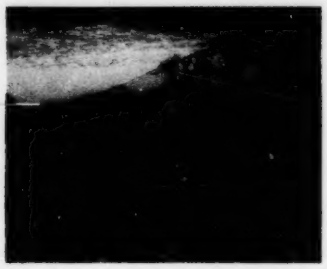
The concentration of human activity along the shoreline has led to habitat loss and has altered natural processes, however considerable progress has been made to combat water pollution. **See pages 10 to 14.**

Offshore waters: MOSTLY RECOVERED BUT UNSTABLE

Major pollution problems have been largely overcome, but fish, plankton and invertebrate communities are very unstable. **See pages 15 to 17.**

Habitat protection and restoration activities have been widespread, through Remedial Action Plans, volunteer-based projects, agency and municipal programs, and private land stewardship. But much more is needed, especially to influence land use on private land. **See pages 18 to 24.**

Challenges for the future? Loss of biodiversity, climate change and the ongoing invasion of non-native species have to top the list. Additional efforts are also needed to conserve the remaining areas of high-quality habitats and to maintain the momentum on cleaning up past pollution.



Not so many years ago, in the 1970s, Lake Ontario was seriously ailing. Mounds of algae and dead alewives fouled its shores. Fish communities collapsed, and many of the fish that remained were too toxic to eat. Many of the beneficial uses that people had come to take for granted—swimming, fishing, water for cities and industry—were impaired.

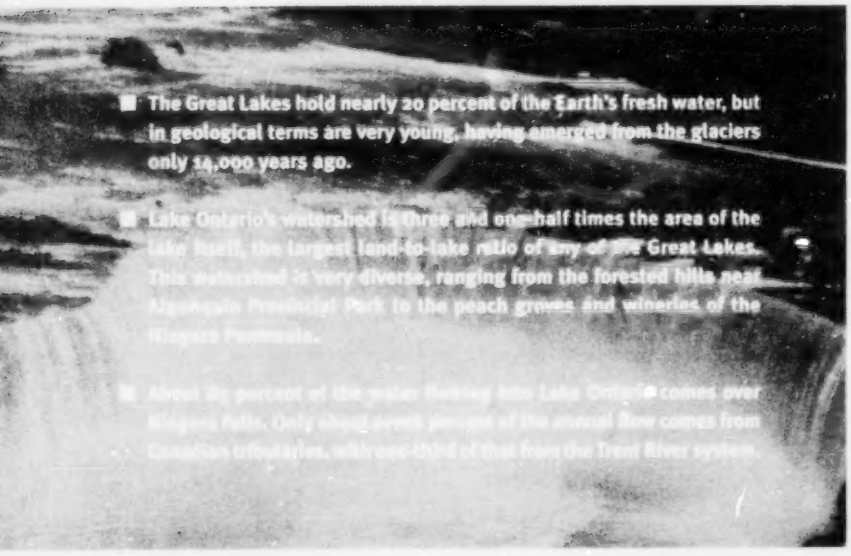
Since then, a determined effort by governments and industry has done much to restore healthy conditions. Strict controls on phosphorus and toxic chemicals have cleaned up the most severe pollution problems. Remedial Action Plans are in place to tackle the most degraded local areas. Waterfront planning has made the shoreline much more accessible and attractive.

But some difficult challenges remain, and we have come to understand that these problems need coordinated actions from all jurisdictions, on both sides of the international border. So the Canadian and U.S. governments, together with the Province of Ontario and the State of New York, are co-operating in a process called the Lakewide Management Plan—or LaMP for short. In 1998, a Stage 1 LaMP report outlined the remaining problems in restoring Lake Ontario to health, and set out ecosystem goals and objectives to guide further work. Follow-up technical reports evaluate in detail the current status of various impairments, including a status report on fish and wildlife habitats on the Canadian side of the lake. This summary provides the highlights from that full report, which is available on the Lake Ontario LaMP web site http://www.on.ec.gc.ca/glimr/lakes/ontario/.

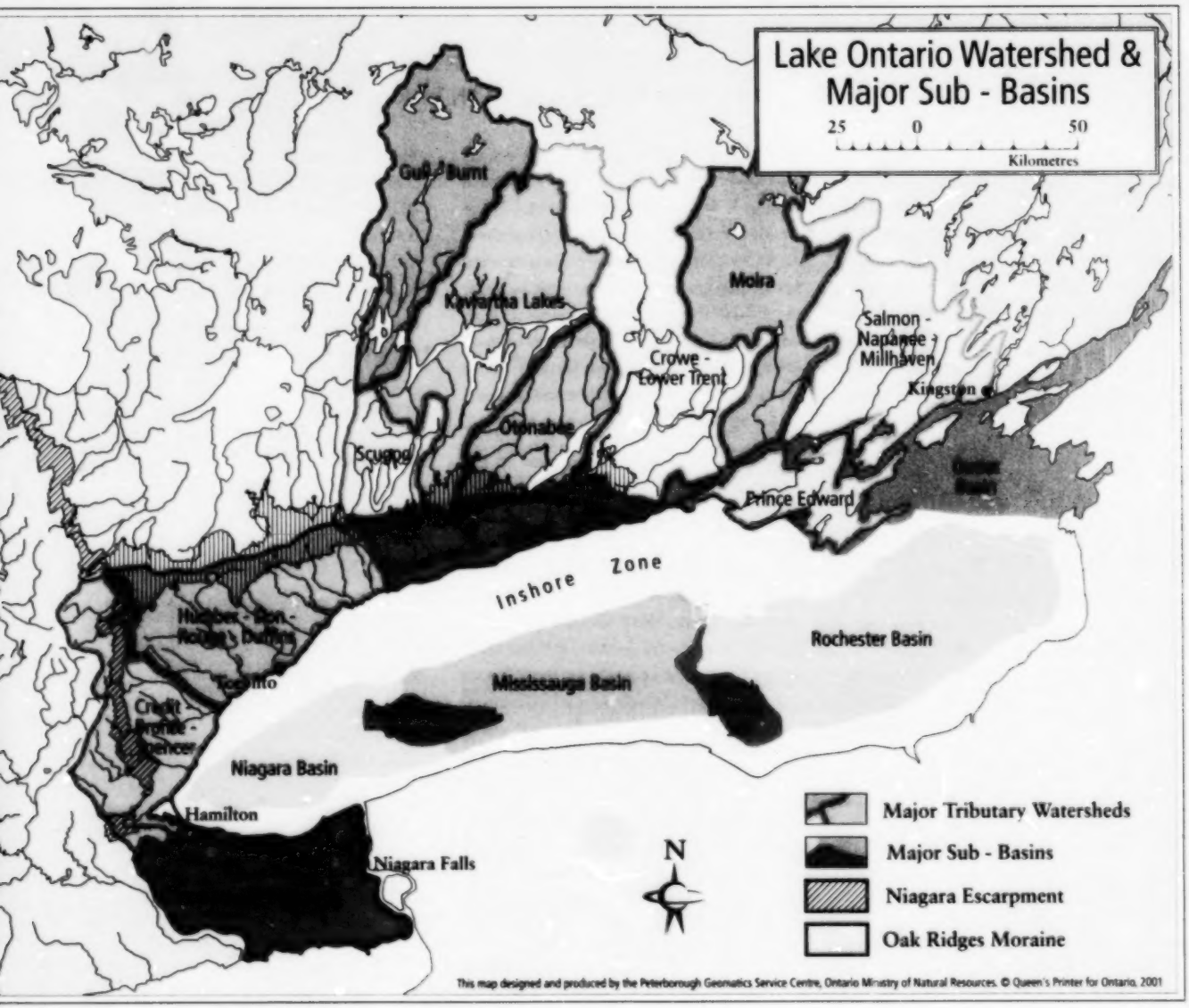
Despite its past abuses, Lake Ontario and its watershed still retain a rich diversity of fish and wildlife. Much of this diversity depends directly on the quality of the habitats—the places where each species finds its own essential mix of food and shelter and breeding territory.

In this report, habitats within the Canadian watershed, the tributaries, the nearshore area, and the deeper waters of the lake itself are examined. The efforts being made to protect high-quality habitats and restore degraded ones, and some of the key issues affecting habitats, are also discussed. This summary is intended to provide a snapshot of habitat conditions in the year 2000, and to encourage you to learn more and become involved in helping to restore this valuable ecosystem.

Photos (From top): www.infoniagara.com; Niagara Peninsula Conservation Authority; Left Text Box – www.infoniagara.com; Right Text Box – Sue Cory; Background – Niagara Peninsula Conservation Authority



- The Great Lakes hold nearly 20 percent of the Earth's fresh water, but in geological terms are very young, having emerged from the glaciers only 14,000 years ago.
- Lake Ontario's watershed is three and one-half times the area of the lake itself, the largest land-to-lake ratio of any of the Great Lakes. This watershed is very diverse, ranging from the forested hills near Algonquin Provincial Park to the peach groves and wineries of the Niagara Peninsula.
- About 85 percent of the water flowing into Lake Ontario comes over Niagara Falls. Only about seven percent of the annual flow comes from Canadian tributaries, with one-third of that from the Trent River system.



The habitats of Lake Ontario don't end at the shoreline; rather they are inter-connected with the lake's tributaries and watershed. For example, most of the fish species in the lake migrate to either tributary streams or shoreline wetlands to spawn and rear their young, and the fouling and destruction of these habitats has a direct effect on the lake's fish populations. Many of the pollutants affecting water quality in the lake—phosphorus, pesticides and so on—arise from land use activities within the watershed, and are carried downstream to settle in the lake. So the LaMP process starts from an ecosystem perspective, recognizing that the land and the lake are intimately connected.

Land use and population growth are putting enormous stress on the Lake Ontario watershed

In Ontario watersheds, preliminary guidelines have been developed to establish how much habitat is needed to support the full range of wildlife species that would occur there naturally. Roughly 30 percent of the watershed should be in forest, with some of that in large patches of at least 200 hectares. More than 10 percent of the watershed should be wetland habitat, including large patches of wooded swampland, and a variety of open marshlands.

But in the two-thirds of the Lake Ontario watershed (i.e. the portion south of the Canadian Shield), those guidelines are tough to meet. Human populations are growing very rapidly, with an increase of 40 percent over the last two decades alone—a growth rate ten times as fast as in the U.S. portion of the watershed. Most of that growth is concentrated in the Greater Toronto Area, where low-density urban sprawl is spilling over the countryside, removing large areas of farmland and natural habitats. This rapid urban growth is projected to continue around Toronto and in the Hamilton-Niagara area.

Rural areas are changing too, with larger farms, fewer farmers, and many more country homes in rural subdivisions or scattered lots. Because these residential uses are often located within scenic wooded areas, they often come into conflict with valuable wildlife habitats. Other land uses such as golf courses and quarries can remove habitat directly, or can affect the flow and quality of surface water and groundwater feeding local streams and wetlands.

Habitats within the watershed can also be affected by airborne pollutants. The amount of pesticides being used on Ontario farms has decreased steadily over the past 15 years (though toxicity may not be), and most other air pollutants within the watershed are either stable or declining. One exception is ground-level ozone, which damages agricultural crops, forests, and natural vegetation. An over-all increasing trend for ozone levels is complicated by the origins of much of this pollution from U.S. sources, and its transport within air masses over long distances.

Photos (From top): Toronto and Region Conservation Authority; Toronto and Region Conservation Authority; Text Box – Lower Trent Region Conservation Authority; Background – Niagara Peninsula Conservation Authority

- While the total number of people living in rural areas is growing, the population of active farmers within the watershed has plummeted from over 66,000 in 1981 to less than 50,000 in 1996 – a drop of over 25 percent in just 15 years.

WOODLANDS ARE GETTING SMALLER, DIMINISHING THEIR VALUE FOR WILDLIFE

Before European settlement, nearly all of the Lake Ontario watershed was forested, with about two-thirds of that in drier upland forests. Clearing for agriculture and towns removed almost 90 percent of the forests south of the Canadian Shield by 1920; since then the amount of woodland has almost doubled in some areas as marginal farmland is abandoned, but remained low in more intensively-used areas such as Niagara and Peel. Today, only a few of the counties within the watershed would meet the 30 percent forest cover guideline for healthy habitat conditions.

But even in areas where forest cover is increasing, the average size of woodlands is getting smaller, as large blocks are broken up by roads, utility corridors, and housing. This fragmentation is a serious concern everywhere south of the Canadian Shield, because it dramatically reduces the amount of "forest interior" habitats available—the sections of a woodlot that are far enough from the edge to be buffered from the effects of extra light and wind and the predators who are most abundant there. Populations of birds that need forest interiors, such as Wood Thrush, Scarlet Tanagers, and Hairy Woodpeckers, are in decline as a result.

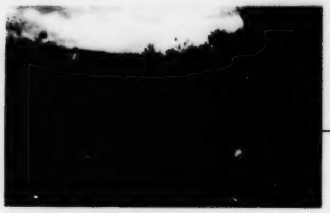
Photos (From top): Lou Wise; George K. Peck; Text Box – John Mitchell

Scarlet Tanager

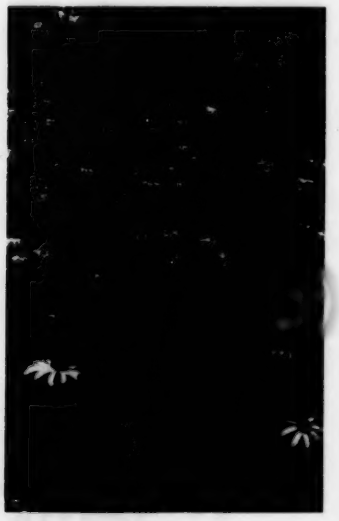
- Bird Studies Canada has identified priority bird species within the Lake Ontario watershed, including those that need large blocks of habitat, those that have low abundance, and those having the core of their breeding range here. When the breeding distribution of these priority species is mapped, nearly all of the richest areas are in the relatively unbroken forests of the Canadian Shield, with a few other isolated pockets along the Niagara Escarpment and the Oak Ridges Moraine.

- One of the most colourful inhabitants of the deep woods is the Scarlet Tanager, whose striking red plumage is set off by black wings. Sadly, the "hoarse Robin" song of the Scarlet Tanager is now missing from much of the watershed, victim of the compulsion to fragment woodlands into smaller and smaller remnants.

- Only 0.07 percent of the remaining forest in southern Ontario is "old-growth", defined as more than 120 years old. Some of this old-growth is contained in twelve Heritage Woodlands, scattered across the watershed (see map on inside front cover).



Spring Peeper



Prairie

WETLANDS AND OTHER NATURAL COMMUNITIES: STILL AT RISK

Wetlands are among the most productive habitats for fish and wildlife. But over three-quarters of the original wetlands have been lost in the western part of the Lake Ontario watershed, and about half in most of the remainder. Today, wetland habitats are concentrated in the Peterborough area, along the southern edge of the Canadian Shield, and along the Niagara Escarpment.

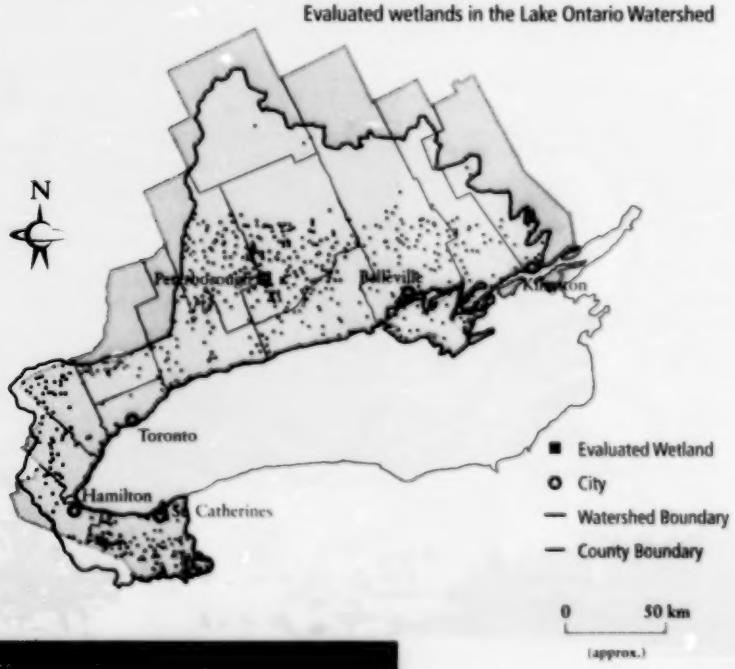
Wetlands loss has been recognized as an important issue for the past two decades, and has been addressed through programs such as a Provincial wetlands policy and evaluation system and cooperative initiatives such as the Great Lakes Wetlands Conservation Action Plan. These measures appear to have slowed the rate of wetlands loss, but not stopped it altogether.

Other habitats at risk within the watershed include limestone cliff and talus communities, prairies and alvars, and Great Lakes coastal communities such as sand dunes. Many of these habitat types have always been rare because they need specialized conditions, but some, such as prairies in the Rice Lake area, were once much more extensive.

Many rare or threatened species are also associated with these communities, with particular concentrations in southerly areas such as Niagara and Halton Region.

Photos (From top): John Mitchell; John Mitchell; P. Allen Woodliff; Text Box – John Mitchell; Background – Niagara Peninsula Conservation Authority

Evaluated wetlands in the Lake Ontario Watershed



■ The Great Lakes Wetlands Conservation Action Plan involves Environment Canada, the provincial government and non-government organizations in cooperative actions to create, reclaim, rehabilitate and protect wetland habitats, with an initial target of 6000 hectares in the lower Great Lakes basin.

Spotted Turtle

HEALTHY TRIBUTARIES DEPEND ON THE LAND AROUND THEM

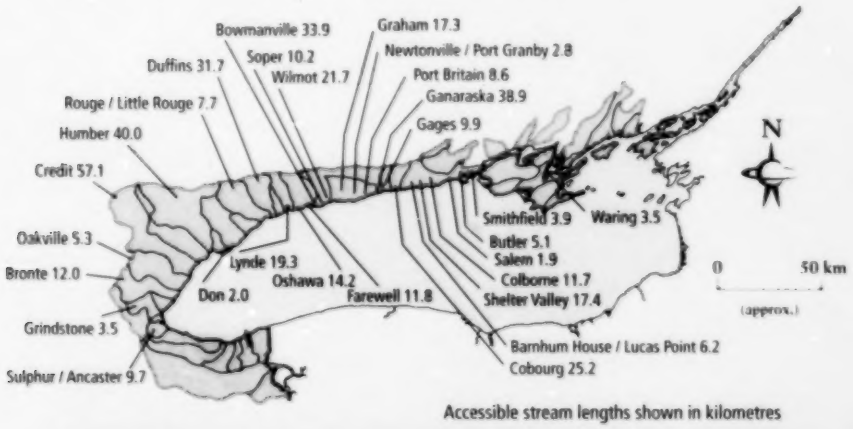
Lake Ontario's tributaries are a varied lot. In the Niagara Peninsula, the Welland River is sluggish and silty. In contrast, the relatively steep, cold-water streams rising from the Oak Ridges Moraine, such as the Credit River, Humber River and Ganaraska River, support good populations of native trout. The Trent River system, which contributes a third of the total flow from Canadian tributaries, has been historically modified with many locks and dams to serve as a canal.

Most of these tributary streams are well-studied, and natural resource managers have developed many reliable ways to document their health. A stream that has 75 percent of its length in natural vegetation, for example, is usually in good shape, especially if that vegetation buffer is at least 30 metres wide on both sides. Fish and invertebrate communities living within the stream provide an index of the quality of its habitat conditions, because some species need pristine conditions and others are much more tolerant. Water quality objectives have been set for many kinds of pollutants. The amount of sediment suspended in the stream water is also an important measure, because this sediment can smother spawning beds and aquatic vegetation.

Both water quality and flow are greatly affected by the activities in the adjacent watershed. When more than 15 percent of the watershed area is covered with pavement and rooftops, these impervious surfaces flush rainfall rapidly into the stream, causing flash floods that tear away at streambanks and create high levels of sediments and other pollutants. Poorly-designed dams also affect tributary health, by blocking fish species that would normally travel upstream from the lake to spawn, and by creating warmer water conditions in the quiet waters above the dams.

Photos (From top): Andy Margetson; Parks Canada Agency; Andy Margetson; Text Box – Mark Heaton, MNR

Coldwater stream habitats accessible from Lake Ontario



Accessible stream lengths shown in kilometres

- 125 kinds of fish occur within Lake Ontario's tributary streams, compared to 95 within the lake itself.
- The lowest point for stream quality was likely during the "Barley Years" in the 1860s, when removal of tree cover and early agricultural practices flushed huge amounts of sediment downstream.

Brook Trout

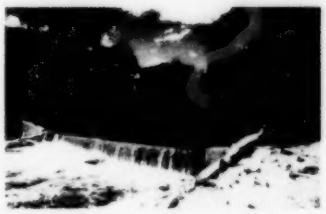
HABITAT CONDITIONS IN MOST STREAM VALLEYS DO NOT COME CLOSE TO MEETING GUIDELINES

How many Lake Ontario tributaries meet the guidelines of 75 percent riparian (streamside) cover and 75 percent buffer width of 30 metres? Very few, according to the sampling of typical streams shown in this chart.

As a result, most of the tributary streams south of the Canadian Shield have impaired fish communities, which are less productive and less diverse than those that occurred historically. Considerable effort has been made to restore stream conditions, especially in the cold-water tributaries which are most valued for sport fish. Tree planting along streams, fencing to keep cattle out, repair of badly eroding banks, and removal of unnecessary dams are all contributing to a slow improvement in stream health. Along the north shore of Lake Ontario, increasing accessibility of the cold-water tributaries to spawning fish from the lake is vital to the recovery of species such as the native Atlantic Salmon, and to sustaining introduced populations of Rainbow Trout and Chinook Salmon.

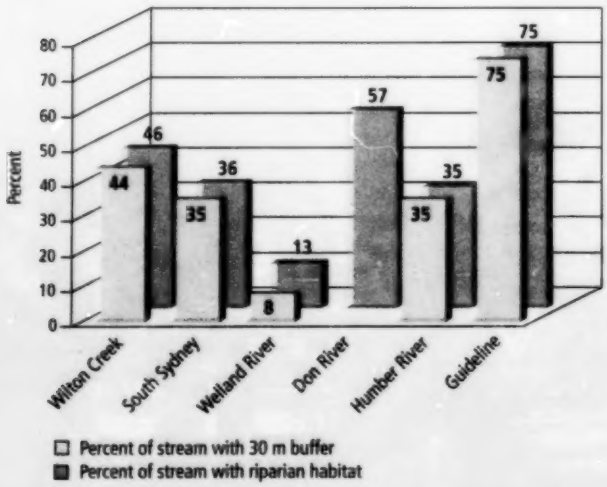
Photos (From top): Mark Heaton, MNR; John Clayton, TRCA; John Clayton, TRCA; Text Box – Janice Smith; Background – Parks Canada Agency

Brook Trout



Fishway

Riparian habitat conditions for selected Lake Ontario streams



■ Past abuses of tributary streams have resulted in several fish species being on the verge of extinction. Redside Dace is designated as threatened in tributaries at the west end of Lake Ontario, as is Channel Darter in several eastern tributaries. River Redhorse is designated as vulnerable in the Trent River. Other aquatic organisms are even more affected—freshwater mussels, crayfish and amphibians are listed as the groups at highest risk of extinction in the United States, and a similar pattern is found here. Freshwater mussels, for example, have declined markedly in the Moira River system.

Fragile Papershell

POLLUTION WITHIN TRIBUTARIES HAS DECLINED BUT OTHER STRESSES ARE STILL PRESENT

For trends across all the Canadian tributaries feeding into Lake Ontario, the news on pollution is generally good. Most water quality samples meet the Provincial Water Quality Objectives for pollutants such as heavy metals and pesticides. Total PCBs are still a problem, coming from either airborne sources or from widespread small sites of contamination. Phosphorus concentrations are often higher than target levels during wet weather, and some metals also show increases in urban streams during rainfalls. While suspended sediment levels vary greatly depending on weather conditions, their concentrations have also shown a gradual decline over the past 25 years.

For other measures of stream health, the news is less positive. As urban growth and intensive agriculture spreads, streamflows are becoming increasingly variable, with very high flows during snowmelt and rainstorms, and low flows during summer dry spells. This rapid run-off rushes rainwater downstream rather than recharging groundwater supplies. Groundwater in many areas is also under stress from water-taking for municipal water supplies, irrigation, and water-bottling. As a result, the cool groundwater that normally sustains stream flows during dry periods is diminishing.

Climate change is expected to have a major impact on tributary streams in the coming years, as effects are felt from decreasing surface runoff and streamflows, significantly less groundwater recharge, and higher summer temperatures. These effects will worsen some of the existing stresses, and make restoration efforts more difficult.

Photos (From top): Andy Margetson; Toronto and Region Conservation Authority; Text Box – Andy Margetson

Wells (groundwater)

- **The Credit River watershed has experienced a five-fold increase in water demand since 1962, and this rapidly increasing demand is expected to continue. In 1999, the Credit River had the lowest water levels in 38 years, raising concerns that groundwater demand may be exceeding the natural supply.**

- **PCBs, or polychlorinated biphenyls, are part of the alphabet soup of pollutants that have affected the Great Lakes. These persistent chemicals accumulate as they pass through the food chain, causing health effects in top-level predators.**

Sand Dunes

Limestone Beach

CONCENTRATED HUMAN ACTIVITY ON THE LANDS AND WATERS OF THE LAKE'S NEARSHORE AREA HAS CAUSED SERIOUS DAMAGE IN MOST AREAS

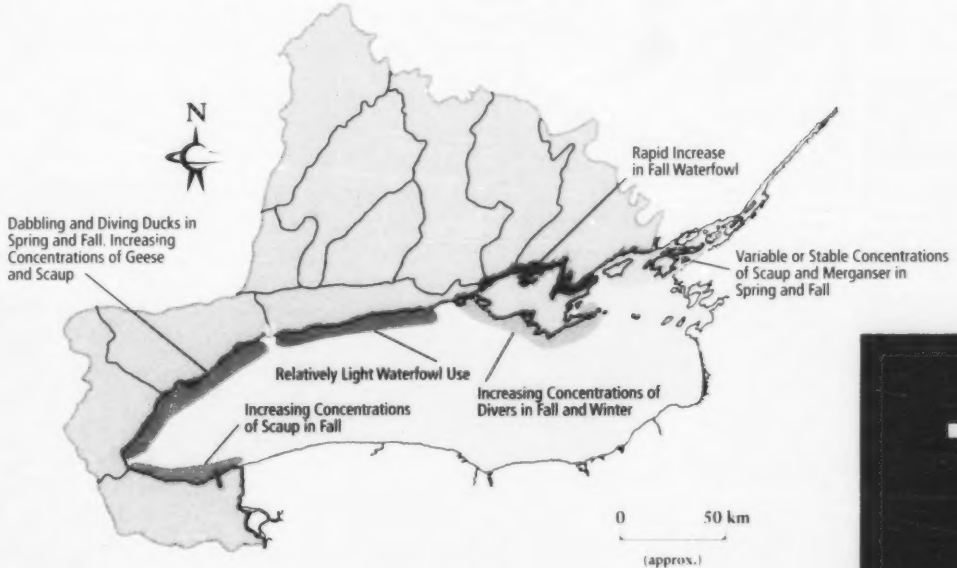
The lakeshore and nearby lands and shallow waters have always been an area rich in life, but over the past three centuries they have also been a focal point for human trade and settlement. As a result, habitat losses in this nearshore zone happened earlier and have been more severe than in other areas. Most nearshore lands have lost almost all of their forest cover. The rivermouth areas where valleys meet the lake, which have often been developed as harbours, are particularly affected—most have only four to ten percent natural cover remaining, far short of the recommended 50 percent.

Coastal wetlands have also been greatly altered, with an estimated 74 percent of the original wetlands between the Niagara River and Toronto lost to development. Further east, wetlands loss has been less widespread, averaging about one-third along the central coast, and only seven percent along the coast of Prince Edward County. An exception to that pattern is a 68 percent loss within the Bay of Quinte, which is now being reversed slowly as a result of restoration programs.

The interaction of lake and land along the water's edge has produced a series of specialized habitats such as sand beaches and dunes, cobble and limestone beaches, shore bluffs, and island clusters. In the more urbanized westerly sections of the shoreline, many of these special features have been destroyed or highly altered. However, the eastern sections of the lakeshore around Prince Edward County and the Outlet Basin still retain high-quality examples of these features. The Lake Ontario Greenway Strategy identified a total of 90 core natural areas along the shoreline, with about half of these having relatively good protection and another one-third having partial protection.

Photos (From top): Doug Boult; Sue Cory; Text Box – Graham Bryan

Trends in waterfowl use of Lake Ontario nearshore waters


N
Rapid Increase in Fall Waterfowl
Dabbling and Diving Ducks in Spring and Fall. Increasing Concentrations of Geese and Scaup
Variable or Stable Concentrations of Scaup and Merganser in Spring and Fall
Relatively Light Waterfowl Use
Increasing Concentrations of Divers in Fall and Winter
Increasing Concentrations of Scaup in Fall
0
50 km
(approx.)

■ The Lake Ontario Greenway Strategy was developed by the Waterfront Regeneration Trust in conjunction with municipalities. It provides direction for environmental restoration, community development, and economic sustainability along the waterfront from Burlington to Trenton.

Considerable progress has been made in cleaning up nearshore water pollution

Cleaning up water pollution in Lake Ontario's coastal waters has been a priority for federal and provincial governments, and indeed the levels of most toxic materials in the waters, sediments, fish and wildlife have declined significantly, often to below target levels. A few substances, notably PCBs and other critical pollutants such as mirex, DDT, dioxin, mercury and dieldrin, remain at elevated levels. In most areas, the phosphorus pollution that previously caused annual blooms of nuisance algae has also been reduced to target levels.

These improving conditions have been reflected in a better balance of aquatic communities and increasing populations of some species. In previously over-enriched areas such as the Bay of Quinte, the over-abundance of algae has been reduced and bottom invertebrates have shifted to a greater mix of clean-water forms. With clearer water conditions, submerged aquatic plants have proliferated, and predator fish such as Walleye have rebounded. Most species of gulls, terns, and cormorants have also experienced rapid population growth in response to dropping contaminant levels in their diet.

Not all of the news is good, however. Common Terns are still showing a consistent population decline, likely related to habitat loss, human disturbance, and competition from gulls for nesting space. Neither Ospreys nor Bald Eagles have yet returned to former nesting areas in significant numbers. And some of the recent improvements in nutrient levels and water clarity are likely a side-effect of the filtering activity of the millions of Zebra Mussels that have invaded the lake, which has enhanced the phosphorus reductions from sewage treatment improvements and farmland stewardship programs.

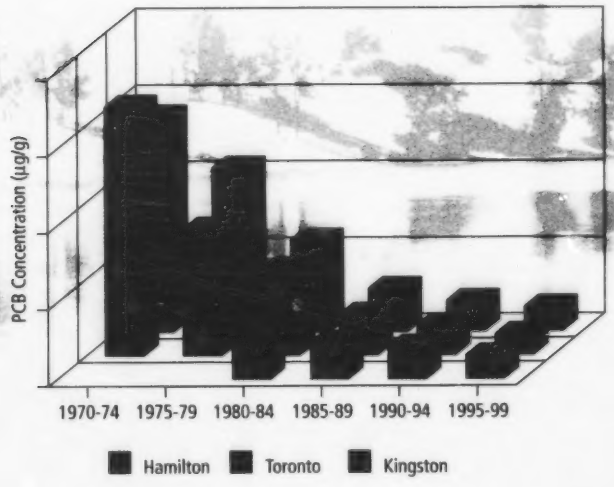
Photos (From top): John Mitchell; Mark Heaton, MNR; Glenn Barrett; Jim Flynn; Background – Dan Blais

Common Tern

Walleye

Osprey

PCB concentrations in herring gull eggs from Lake Ontario colonies



Lake Ontario's Hidden Treasures

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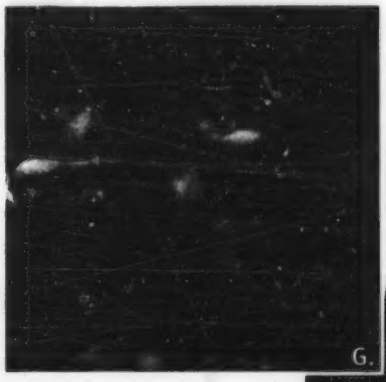
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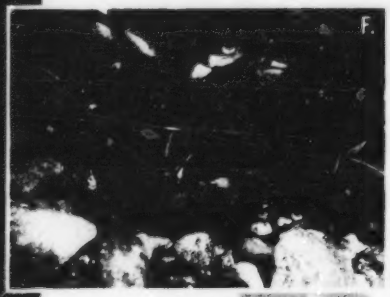
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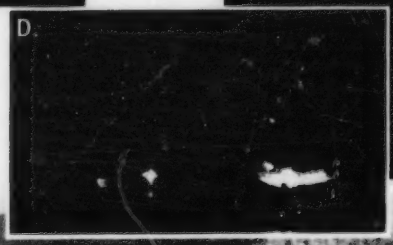
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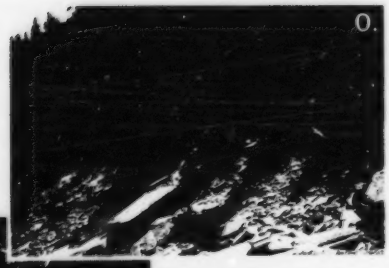
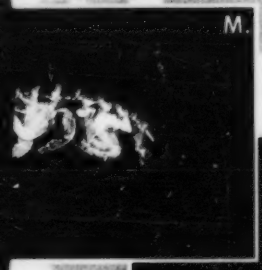




A. – **Pink** Lady's Slipper Orchid, O. **Langley**

B. – **Cobble beach, Sue Cory**

C. – Yellow Lady's Slipper Orchid, Anonymous

D. – **Long-tailed Duck, George K. Peck**

E. – **Black Tern, John Mitchell**

F. – Atlantic **Salmon** Fry, Mark Heaton, MNR

G. – Gaywings, FON archives

H. – Indian Paintbrush, FON archives

I. – Grey-headed Coneflower, Ross Brown

J. – Purple Fringed Orchid, L. Thurston

K. – Barrier beach marsh, Anonymous

L. – Least Bittern, George K. Peck

M. – Hyallela azteca, Trefor Reynoldson

N. – Sand beach, Sue Cory

O. – Cliff and talus (limestone), Graham Bryan

P. – Fringed Gentian, FON Archives

Q. – Alvar, Graham Bryan

R. – **Gray Tree Frog, John Mitchell**

S. – **Shore Bluffs, Toronto and Region Conservation Authority**

Background – Dan Bale

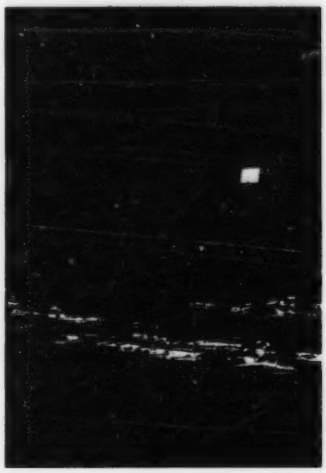
Further recovery of the nearshore area will depend on renewed efforts to address several stresses

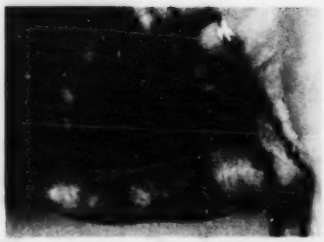
By its very nature, the nearshore zone is dynamic—it not only responds quickly to changing conditions, in some ways it needs an environment of constant change. But the natural rhythm of change has been disrupted in several ways, which will hold back further recovery of habitats in this area until these stresses are addressed.

For example, a critical natural process is the scouring of sands from lakeshore bluffs by the action of waves, and the transport of that sand to beach areas where it is deposited. Armouring the shoreline with seawalls, groynes or boulders disrupts that process, and can result in erosion of beaches and a lack of regular flushing of shoreline areas. Armoured shorelines are especially common in the western part of the lakeshore, where between 35 percent and 38 percent of the shore has been hardened. Another important natural process is the regular fluctuation of water levels, which is essential to renew coastal wetlands and dunes. Since 1960, water levels on Lake Ontario have been partially controlled to assist shipping, power generation and recreational uses, leading to a reduction in these fluctuations and a deterioration in habitat quality in many areas.

On the other hand, too much change can overwhelm natural processes. This is the case with Zebra and Quagga Mussels, which now dominate the lakebed communities, crowding out native clams and causing significant changes in plankton, invertebrate and fish communities. Other non-native species such as Purple Loosestrife and Eurasian Watermilfoil in coastal wetlands can also cause serious disruption to natural communities. In future, climate change may be another factor causing widespread changes faster than nearshore ecosystems can adapt. Lower water levels, higher summer temperatures, and reduced winter ice cover may have major ramifications to the future habitats of this zone.

Photos (From top): Parks Canada Agency; Graham Bryan; Wendy Crowell, Minnesota DNR; Martha L. Walter; Text Box – Janice Smith; Background – Toronto and Region Conservation Authority





Eurasian Watermilfoil

Purple Loosestrife

■ An individual Zebra Mussel is smaller than your thumb, but in the millions, their effect is enormous. The entire volume of Lake Ontario is now filtered through mussels about once a year. In the lower section of the Bay of Quinte, the total water volume passes through mussels in just over one hour!

Comm

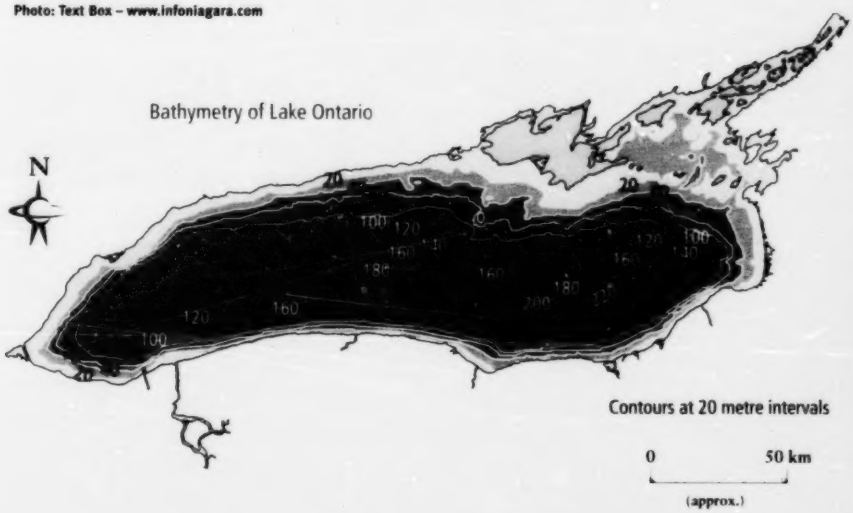
In the deeper offshore waters, pollution problems have been largely, but not completely, overcome

Lake Ontario is a relatively deep, smooth-sided basin, so features such as water temperature, oxygen levels, and nutrients play a major role in defining habitat conditions within the open lake. The lake is divided into four basins, with the most easterly Outlet Basin being the shallowest and most nutrient-rich—characteristics that are reflected in the plankton and invertebrate communities there. The Niagara Basin, at the western end of the lake, includes the greatest diversity and abundance of plankton in Lake Ontario, and a mix of lakebed invertebrates that includes some that are tolerant of enriched conditions. The central two basins are deep, cold and nutrient-poor.

Tiny particles of sediment, which gradually settle onto the lake bottom, are an important part of this ecosystem. Most of these sediments come from tributary streams, with about 50 percent of the total arriving through the Niagara River. These sediments are often contaminated by a variety of toxins, which tend to remain within the bottom muds. While the amount of contaminants arriving in the lake has dropped significantly, the role of those remaining in the bottom sediments is less clear. For some larger species of predatory fish which accumulate toxins, consumption advisories are still in place.

On the other hand, declining nutrient levels in the open lake waters have been a major success story. Levels of phosphorus measured in offshore waters have been consistently below the targets set back in the 1970s for over a decade, and eutrophication (or over-enrichment) is no longer a problem in the open lake.

Photo: Text Box – www.infoniagara.com



- How much of a difference has phosphorus control made to Lake Ontario? Since the early 1980s:
  - water clarity has increased by 20 percent
  - photosynthesis has decreased by 18 percent
  - late summer zooplankton production has declined by 50 percent

  All of these are positive changes showing a shift back to original conditions of low nutrient levels, and indications of a healthier aquatic ecosystem.

Alewife

OFFSHORE FISH COMMUNITIES ARE DOMINATED BY INTRODUCED SPECIES AND ARE VERY UNSTABLE

In the deep offshore waters of Lake Ontario, where habitat conditions are relatively uniform, fish populations are largely controlled by a complex web of predator and prey species, the plankton and invertebrates that serve as a food source, and the nutrient levels that sustain this system. Historically, this ecosystem supported large numbers of Lake Trout and Atlantic Salmon as the top predators, with a diverse mix of ciscoes, sculpins, and other prey fish at the heart of the food web.

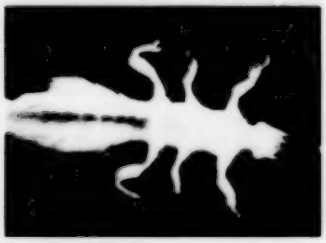
Today, that community has been largely replaced by introduced species. Only a small population of Lake Herring remains from a historic community of four cisco species. One of the three sculpin species, the Deepwater Sculpin, was thought to be extinct as well, but began to appear again in very small numbers in 1996. The prey fish community has been almost entirely replaced by Alewives and Rainbow Smelt, both introduced species. Atlantic Salmon, which once crowded tributary streams to spawn, disappeared long ago, although efforts are underway to re-introduce this species to the lake. Lake Trout are slowly beginning to recover, after decades of heavy stocking, but the dominant predators are Chinook Salmon and Rainbow Trout, introduced from Canada's west coast.

Over the past two decades, as nutrient levels and plankton abundance fell and stocked salmon increased in numbers, the over-abundance of Alewives has decreased significantly. This has had a number of beneficial effects, including a resumption of successful spawning by Lake Trout, and increasing populations of Lake Whitefish, Threespine Stickleback, and other native fish. A diet high in Alewives causes early mortality in Lake Trout, and possibly Atlantic Salmon, because of thiamine deficiency, so Alewife abundance acts as a major impediment to the recovery of these native species. On the other hand, the introduced Chinook Salmon, a popular sport fish, prefers to feed on Alewives, which is creating a management demand for more, rather than fewer, of this prey species.

At this point, the future of the lake's deepwater fish community is highly unpredictable. The effects of Zebra and Quagga Mussels in diverting nutrients have not yet been fully felt, the re-establishment of a diverse native community of prey fish is highly uncertain, and the diet of significant species such as Lake Whitefish seems to be changing. So while aquatic habitat conditions have been restored to close to their historical quality, the fish communities are still in a state of transition towards some unknown endpoint.

Photos (From top): Great Lakes Fishery Commission; Mark Heaton, MNR; Background – Mark Bacro

Benthic Worms



Burrowing Mayfly

Spiny Water Flea

MAJOR SHIFTS ARE OCCURRING IN PLANKTON AND INVERTEBRATE COMMUNITIES AND FUTURE CHANGES ARE LIKELY

The tiny plants and animals that float within the lake waters and live on the lakebed are the base of the aquatic food chain, and a valuable indicator of the health of these habitats. For example, Lake Ontario's phytoplankton—its microscopic floating plants—declined by about 30 percent between 1972 and 1992, as phosphorus controls reduced nutrient pollution levels. There has also been a shift in the kinds of phytoplankton present, with less edible forms becoming more common.

The annual crop of zooplankton—microscopic floating animals—has declined even more, by an estimated 50 percent. This is probably associated with the changes in the phytoplankton communities, which are their food source, and grazing by Alewives, which remove the larger forms of zooplankton.

Benthic organisms include invertebrates such as worms, crustaceans, and opposum shrimp that live in direct contact with the lake bottom mud. In this location, they are very sensitive to toxic contaminants that arrive with the settling out of sediments. Their abundance appears to have decreased significantly since the 1960s, and in the past several years there has been a dramatic decline in a small crustacean called *Diporeia*, which formerly was by far the most common benthic organism.

The sudden loss of *Diporeia*, whose abundance has been considered an indicator of good environmental quality, is a signal of significant instability in the open lake community. While further assessment of any potential role of toxic chemicals in this decline is needed, it appears more likely that their population collapse is yet another side-effect of the explosive growth of Zebra and Quagga Mussels. In the deeper sections of the lake, where mussel populations are still expanding, the full impact of their invasion has not yet been felt, and further shocks to natural communities can be expected.

The potential for impacts from other non-native species is also considerable, as new exotic species continue to be introduced from ballast water from overseas shipping and other sources. Some recently-introduced species in the Great Lakes system, such as a fish called Ruffe and a zooplankton species called Spiny Water Flea, may take advantage of the unstable conditions in Lake Ontario to expand rapidly as well.

Photos (From top): Trefor Reynoldson; Trefor Reynoldson; J. Lindgren, Minnesota DNR;

REMEDIAL ACTION PLANS HAVE PROVIDED A FRAMEWORK FOR MANY HABITAT RESTORATION PROJECTS

A wide range of habitat restoration projects have been completed over the past decade, most of them in association with RAPs. Environment Canada's Great Lakes 2000 Cleanup Fund (now the federal government's Great Lakes Sustainability Fund) has provided financial support for many of these projects. Other cooperative programs such as the Great Lakes Wetlands Conservation Action Plan, provided a framework for setting priorities and encouraging joint actions.

Most habitat restoration projects fall within four categories:

- Wetland restoration, such as creating open water areas in the dense cattails of Sawguin Creek Marsh in the Bay of Quinte, the creation of Pike spawning areas in the Toronto Islands wetlands, creation of new wetlands and planting of aquatic vegetation at Colonel Sam Smith Park in Etobicoke, and development of carp barriers to allow rehabilitation of aquatic vegetation in Hamilton's Cootes Paradise wetlands.

- Stream or riparian habitat enhancement, including hundreds of individual projects with farmers to fence livestock out of streams, plant trees along stream corridors, improve manure management, and reduce erosion through no-till agriculture, as well as projects to remove dams blocking fish passage, replace concrete channels with naturalized habitats, and update septic systems that affect water quality.

- Strategic planning studies, to examine areas with complex problems and identify priority actions, to prepare state-of-the-watershed studies for areas such as the Don River, Etobicoke Creek and Mimico Creek, and to plan longer-term projects such as the recovery of Lake Sturgeon in the Bay of Quinte.

- Shoreline habitat restoration, including such projects as the construction of three islands in Hamilton Harbour for nesting colonial waterbirds, installing floating rafts for Black Tern in Cootes Paradise, and placing Osprey and Bald Eagle nesting platforms in various locations.

Photos (From top): Ducks Unlimited; Lower Trent Region Conservation Authority; Royal Botanical Gardens; John Hall; Text Box – Toronto and Region Conservation Authority; Background – John Mitchell

- Remedial Action Plans (RAPs) have been established as cooperative projects among federal and provincial agencies, municipalities, conservation authorities, and community groups to address the needs of the most seriously degraded areas along the Great Lakes coast. On the Canadian shore of Lake Ontario, RAPs are currently underway for the Bay of Quinte, Port Hope Harbour, Toronto and Region, Hamilton Harbour, and the Niagara River, including the Welland River watershed.

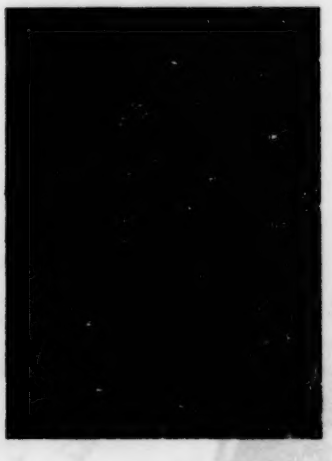
VOLUNTEERS ARE MAKING RESTORATION HAPPEN THROUGH HUNDREDS OF COMMUNITY PROJECTS

Habitat restoration is not an activity involving only governments—hundreds of other projects have been carried out across the Lake Ontario watershed over the past decade by volunteer groups. Many of these projects have been supported through Environment Canada programs such as Action 21 and EcoAction 2000, and through such Ontario Ministry of Natural Resources programs as the Community Wildlife Involvement Program and Community Fisheries Involvement Program.

Projects close to home are especially appealing to volunteers, and many of these community-level projects take place in urban settings. Tree-planting programs are especially popular, as are naturalization projects in school yards, parks, and shoreline areas. But other kinds of habitat restoration also take place, such as stream channel enhancements (e.g. along the Humber River) and even controlled burns to restore historic savannas (e.g. in Toronto's High Park).

The agricultural community has also been active in environmental programs, through Rural Conservation Clubs to promote and demonstrate good stewardship and such activities as no-till cropping to reduce erosion. A series of Best Management Practices booklets for farmers have been developed, covering farm forestry and habitat management, water management, and wildlife management. One of the most far-reaching programs is the Environmental Farm Plan initiative, which was developed by a coalition of farm associations and is delivered through local chapters of the Soil and Crop Improvement Association.

While many worthwhile volunteer projects have been completed, they tend to be scattered and uneven, and could benefit from greater coordination to direct efforts towards such priority actions as restoring larger blocks of upland forest.



Photos: Andy Rockall; Gera Dillon; Tent Bee – John Mitchell

- Environmental Farm Plans encourage individual farmers to assess environmental issues in their operations through workshops and the completion of a workbook. A total of 23 topics are included, such as pesticide storage and management, manure management, and rural septic systems. In areas where problems are identified, small grants are often available to assist farmers to address priority issues.

- One of the largest non-government organizations involved in habitat restoration is Ducks Unlimited Canada, which has completed dozens of wetland creation and rehabilitation projects, particularly in the eastern sections of the Lake Ontario watershed. Non-government organizations have also taken over much of the task of supplying young trees for planting projects, a service formerly provided by the Ministry of Natural Resources and conservation authorities.

- All habitat restoration projects have value, and the past decade has seen a great increase in interest in this area, but on a watershed scale, the current projects tend to be scattered and opportunistic. Much more needs to be done to strategically protect, connect and restore habitats across the watershed.

Monarch

- In the Riverdale and Cabbagetown neighbourhoods in Toronto, rainwater run-off has been reduced by directing stormwater away from sewers, and into rainbarrels, laneway "sock away" pits, and a commercial parking lot swale. This project reduces pollution carried by run-off into the lower Don River, and increases the recharge of groundwater in this urban area.

- With the assistance of the community group Friends of Second Marsh, private landowners have returned over two kilometres of streambanks to natural conditions. Native trees, shrubs and wildflowers have been planted, eroding streambanks stabilized using natural materials, and in-stream fish habitats created in key locations.

- The "Caring for your Watershed" program sponsored by the Black Creek Project in northwestern Toronto has involved 1500 people from schools and community groups in environmental rehabilitation projects in this mostly urban watershed. Who wouldn't want to help place [illegible] buried logs known as stumps in streams to [illegible]

- Volunteers also have the opportunity to participate in a wide range of ecological monitoring programs. For example, the Marsh Monitoring Program, a joint effort of Bird Studies Canada and Environment Canada, tracks populations of marsh birds and frogs at wetland [illegible] A complementary program to track changes in bird life, the [illegible] Breeding Bird Atlas, was first completed in 1981 through [illegible], and is being repeated in the 2001 to 2005 period.

SOME OF THE BEST NATURAL HABITATS ARE PROTECTED THROUGH OWNERSHIP OR MANAGEMENT BY GOVERNMENT AGENCIES

Ontario's provincial parks system protects a cross-section of the best of the natural habitats in the Lake Ontario watershed—from relatively large natural environment parks such as Bon Echo and Presqu'ile, to small nature reserves such as the old-growth hardwoods in Peter's Woods. In total, 21 provincial parks are found within the watershed, plus a narrow corridor of federal parklands along the Trent-Severn Canal.

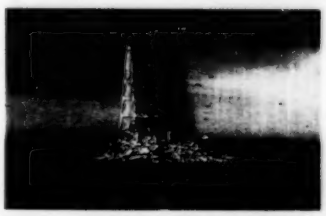
The Ontario Living Legacy program recently announced the establishment of six new conservation reserves and four new parks and park additions within the watershed, which together will add almost 50,000 hectares of protected landscapes.

Conservation authorities are also major owners of natural habitats, with almost 36,000 hectares of land within the Lake Ontario watershed, especially along the Niagara Escarpment and in wetlands and valley corridors. Many of the Counties and Regions also have extensive managed forest holdings, particularly along the Oak Ridges Moraine.

A variety of other agency lands, from Environment Canada's National Wildlife Areas to the Royal Botanical Gardens, also protect valuable natural habitats.

Nonetheless, an evaluation of how well different types of landscapes are represented within protected areas, carried out by World Wildlife Fund Canada, shows that in almost all areas, existing parks are seriously deficient in protecting the full range of habitats and species. While some acquisition of priority lands is still taking place along the Niagara Escarpment and in a few valleys and wetlands, funding for major habitat protection projects is very limited.

Prince Edward Point National Wildlife Area



Scotch Bonnet National Wildlife Area

Photos (From top left to top right): Mark Heaton, MNR; Pete Ewins; Mark Heaton, MNR; Laurie Maynard; Jeff Robinson; Jeff Robinson; Left Text Box – Credit Valley Conservation Authority; Text Box Below – Credit Valley Conservation Authority; Background – John Mitchell

- Since 1995, the federal Ecological Gifts Program has provided income tax incentives to encourage landowners to donate ecologically sensitive lands to conservation organizations. Recent federal Budgets announced improved tax benefits for donors. The program is delivered by Environment Canada and partners and is an important tool for conserving Canada's biodiversity. To date 13 land donations and nine conservation easements have been accepted within the Lake Ontario watershed, protecting an additional 760 hectares.

PROVINCIAL AND REGIONAL PLANNING POLICIES PROVIDE SOME PROTECTION FOR NATURAL HABITATS ON PRIVATE LAND

Development activities within the watershed are influenced by municipal official plans and provincial planning policies. A new Natural Heritage Policy was introduced by the Province in 1995, with the intention of protecting natural heritage features and areas from incompatible development. However, across the Lake Ontario watershed and elsewhere in the province, this policy is not incorporated consistently into municipal official plans, limiting its effectiveness.

Some municipalities, especially at the regional level, have identified Environmentally Significant Areas, and incorporated policies for their protection within their official plans. As well, most of the conservation authorities within the watershed have developed watershed or subwatershed plans, as well as shoreline management plans for the coast of Lake Ontario. Protection of fish and wildlife habitats is usually an important element of these plans.

A wide range of other planning processes, with varying degrees of strength, have been carried out within the watershed. For example, the Niagara Escarpment Plan provides very strong protection for natural habitats through a provincially-appointed Commission that controls land use. The Lake Ontario Greenway Strategy, while developed through a provincial-municipal partnership, depends largely on municipal involvement for its implementation. An Oak Ridges Moraine Strategy, developed through an extensive planning process in 1994, has not yet been approved by the Province.

Photos: Lesley Dunn; John Mitchell; Text Box – John Mitchell; Background – John Mitchell

■ How do we ensure that the full range of natural diversity is included within a system of protected areas? One good starting point is the slate of 256 Areas of Natural and Scientific Interest (ANSIs) identified across the watershed by the Ministry of Natural Resources. ANSIs can be either life science or earth science, and are selected as particularly good examples of ecological and geological features within a landscape. So an ANSI might contain a section of limestone cliff, or a clay plain lowland forest, or a fine specimen of a kettle bog. Taken together, they provide a foundation for natural heritage appreciation, scientific study, and education.

STEWARDSHIP OF NATURAL HABITATS BY PRIVATE LANDOWNERS IS A VITAL CONSERVATION ACTIVITY

Because most of the land within the Lake Ontario watershed is privately owned, the actions of private landowners are critical to the future of fish and wildlife habitats. Private land stewardship involves the safeguarding of natural habitats on a voluntary basis, often in partnership with agencies and conservation organizations who provide advice and incentives.

Promotion of private land stewardship often comes through landowner contact programs, in which specially trained staff from conservation organizations visit with landowners to exchange information, provide advice on management of natural areas, and recognize voluntary efforts. Over the past decade, several major landowner contact programs have been carried out in the Lake Ontario watershed, involving such habitats as significant wetlands, Niagara Escarpment lands, natural areas in the Lower Trent area, and watershed protection areas in Niagara, Hamilton, Oshawa, and the Bay of Quinte region.

One significant incentive for landowners is the Conservation Lands Tax Incentive Program, which provides a property tax exemption for significant wetlands, ANSIs, endangered species habitats, and Niagara Escarpment natural areas enrolled in the program.

At the community level, stewardship is often associated with land trusts, non-profit voluntary organizations that accept donations of natural lands or conservation easements, and work to encourage landowners to undertake conservation activities. For example, the Hastings-Prince Edward Land Trust has identified the south shore of Prince Edward County as a special project area. Valleys 2000 (Bowmanville) is undertaking a major habitat restoration project along Bowmanville Creek. A new land trust on the Oak Ridges Moraine recently accepted its first land donation, and has ambitious plans for the future.

Photos: Graham Bryan; Andy Margetson

While past efforts have been partially successful, many habitats remain at risk

Humankind has not been gentle to the ecosystem of Lake Ontario and its watershed. The lake and the lands that drain into it have seen a history of significant abuse since the time of European settlement. While the nature of that abuse has changed over the decades, and while the ecosystem has shown a remarkable capacity to repair our damage, new forms of stress keep appearing. Unless ways can be found to provide relief from the cumulative effects of these stresses, habitats of the future are likely to be less rich in species and interactions, less resilient, and less able to endure further stress.

Fortunately, the recent history of Lake Ontario demonstrates that such relief would not be without precedent. Major stresses of a generation ago, most notably nutrient enrichment and toxic contaminants, have been remarkably reduced. The lake ecosystem has responded, and fish and wildlife populations once on the verge of extinction have rebounded. While still unstable, the offshore habitat zone has largely recovered, and the nearshore zone has shown partial recovery. Despite site-specific improvements in many areas, much of the watershed, tributaries, and nearshore lands remain significantly degraded.

A significant array of habitat conservation and restoration programs are in place within the Lake Ontario watershed, and some of these programs have had notable recent successes. But it is clear that much more is needed, particularly to influence land use on private lands, where current programs are only partially effective.

Two "super-stressors"—climate change and exotic species invasions—have the potential to overwhelm the progress now underway, and to seriously destabilize the Lake Ontario ecosystem. To build on past success in addressing habitat issues, strategies to effectively address these emerging issues must be developed, restoration efforts must continue, and new efforts must focus on conserving the areas of high habitat quality that remain. Only through such ongoing effort can the future of the rich diversity of fish and wildlife in Lake Ontario and its watershed be assured.

Photos (From top): John Mitchell; John Mitchell; John Mitchell; Background – John Mitchell

Spotted Turtle

Hooded Warbler

For more information on the Lake Ontario LaMP and how you can become involved in habitat conservation, visit the following websites:

Lake Ontario Lakewide Management Plan
www.on.ec.gc.ca/glimr/lakes/ontario/

Remedial Action Plans
www.on.ec.gc.ca/glimr/raps/intro.html

Wildspace
www.on.ec.gc.ca/wildlife/wildspace/intro.html

EcoAction
www.on.ec.gc.ca/ecoaction/home.html

EcoAction - Community Animation Program
http://www.on.ec.gc.ca/ecoaction/cap.html

Great Lakes Sustainability Fund
www.on.ec.gc.ca/green-lane/cuf/

Ducks Unlimited Canada
http://www.ducks.ca/

Wetland Habitat Fund
www.wetlandfund.com/

Great Lakes Wetlands Conservation Action Plan
www.on.ec.gc.ca/green-lane/wildlife/glwcap/

Wildlife Watchers
www.on.ec.gc.ca/wildlife/wild-watchers/wild-watchers.html

Conservation Ontario
www.conservation-ontario.on.ca/

Federation of Ontario Naturalists
www.ontarionature.org/

Environmental Farm Plan
http://res2.agr.ca/london/gp/efp/efpmenu.html

Ecological Gifts Program
www.on.ec.gc.ca/wildlife_e.html

Ontario Ministry of Natural Resources
http://www.mnr.gov.on.ca/MNR/

Ontario Natural Heritage Information Centre
www.mnr.gov.on.ca/MNR/nhic/nhic.html

Carolinian Canada's Big Picture Project
www.carolinian.org/Big%20Picture.htm